

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. APPLN. NO. 09/879,175
ATTORNEY DOCKET NO. Q64846

REMARKS

Applicant requests the Patent Office acknowledge Applicant's claim to foreign priority, and to indicate that the certified copy of the priority document, European Patent Application No. 00401763.8 dated June 20, 2000, has been made of record in the file.

Applicant thanks the Patent Office for initialing the references listed on the PTO-1449 form submitted with the Information Disclosure Statement filed on June 13, 2001 and returning an initialed copy of the PTO-1449, thereby confirming that the listed references have been considered.

The Patent Office has not indicated if the Drawings originally filed with the application on June 13, 2001 are acceptable. Applicant respectfully requests that the Patent Office indicate in the next communication from the Office if the Drawings are acceptable.

Claims 1-4 have been examined on their merits.

Applicants herein add new claims 5-10. New claims 5-10 are supported by the specification and the originally filed claims. Entry and consideration of the new claims 5-10 is respectfully requested.

Claims 1-10 are all the claims presently pending in the application.

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1. Claim 1 stands objected to as containing informalities. Applicant herein amends claim 1 to remove the informality, and respectfully requests that the objection to claim 1 be withdrawn.

2. Claims 3 and 4 stand rejected under 35 U.S.C. § 112 (2nd para.) as allegedly being indefinite. Applicant traverses the § 112 (2nd para.) rejection of claims 3 and 4 for at least the reasons discussed below.

Applicant has amended claims 3 and 4 so that they are directed to a network that comprises a communications element that uses at least one communications stack as recited in claim 1. Applicant submits that the § 112 (2nd para.) rejection of claims 3 and 4 has been overcome, and respectfully requests withdrawal of same.

3. Claims 1 and 3 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Grant *et al.* (U.S. Patent No. 5,027,269). Applicant traverses the § 102(b) rejection of claims 1 and 3, and insofar as the rejection applies to new claims 5-10, for at least the reasons discussed below.

To support a conclusion that a claimed invention lacks novelty under 35 U.S.C. § 102, a single source must teach all of the elements of a claim. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379, 231 U.S.P.Q. 81, 90 (Fed. Cir. 1986). A claim is anticipated only if each and every element as set forth in the claim is found either expressly or inherently in a single prior art reference. *Verdegual Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). A single source must disclose all of the claimed

elements arranged as in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). A proper anticipation rejection requires that every element of the claim be found “in a single prior art reference.” *See In re Robertston*, 169 F.3d 743, 745, 49 U.S.P.Q.2d 1949, 1950 (Fed. Cir. 1999). For anticipation to exist, there must be no difference between the claimed invention and the reference disclosure, as that reference would be understood by one of ordinary skill in the art. *See Scripps Clinic & Research Found. v. Genentech, Inc.*, 927 F.2d 1565, 1576, 18 U.S.P.Q.2d 1001, 1010 (Fed. Cir. 1991); *see also, Crown Operations Intn’l, Ltd. v. Solutia, Inc.*, 289 F.3d 1367, 62 U.S.P.Q.2d 1917 (Fed. Cir. 2002). Rejections under 35 U.S.C. § 102 are proper only when the claimed subject matter is identically disclosed or described in the prior art. Thus, the cited reference must clearly and unequivocally disclose every element and limitation of the claimed invention.

Grant *et al.* fails to teach or suggest a communications stack that is used by one of two applications programs that are communicating with each other, as recited in claim 1. In Grant *et al.*, the connection between the session communications services (30) and the address space containing the active logical unit is maintained. When an application logical unit fails or an alternate logical unit initiates a take-over, the active sessions of the logical unit are disconnected from any application logical unit for some period of time. The access method of Grant *et al.* assumes responsibility for the active sessions from the time the failure is detected until the recovery (alternate) logical unit indicates that it is prepared to assume responsibility for the sessions. In contradistinction, connections in the present invention are persisted by not closing (resetting) the connection at an application crash and leaving the rest of the network ignorant

about the application crash. In Grant *et al.*, the connections (session) are actively kept persistent in case of an application crash by means in the communications network. To the contrary, in the present invention, only the endpoint at the side of the crashing application needs to be adapted. In other words, the persistent connection in the present invention is transparent for the application running on the peer node.

Based on the foregoing reasons, Applicant submits that Grant *et al.* fail to teach or suggest all of the claimed elements as arranged in claim 1. Therefore, under *Hybritech* and *Richardson*, Grant *et al.* clearly cannot anticipate the present invention as recited in independent claim 1. Thus, Applicants submit that claim 1 allowable, and further submit that claims 3 and new claim 5 are allowable as well, at least by virtue of their dependency from claim 1. Applicants respectfully request that the Patent Office withdraw the § 102(b) rejection of claims 1 and 3.

With respect to new independent claim 6, Applicants submit that claim 6 is allowable for at least reasons analogous to those discussed above with respect to claim 1. Therefore, under *Hybritech* and *Richardson*, Applicants submit that claim 6 is allowable, and further submit that claims 7-10 are allowable as well, at least by virtue of their dependency from claim 6.

4. Claim 2 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Grant *et al.* Applicant traverses the § 103(a) rejection of claim 2, and insofar as the rejection might apply to new claim 7, for at least the reasons discussed below.

Applicant submits that since claim 2 depends upon claim 1, and since the Patent Office does not cite a reference that cures the deficient teachings of Grant *et al.* with respect to claim 1, Applicant submits that claim 2 is patentable at least by virtue of its dependency. Applicants respectfully request that the § 103(a) rejection of claim 2 be withdrawn.

Applicant submits that new claim 7 is allowable for at least the same reasons as claim 2.

5. Claim 4 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Grant *et al.* in view of Cain *et al.* (U.S. Patent No. 6,757,289). Applicant traverses the § 103(a) rejection of claim 4, and insofar as the rejection might apply to new claim 10, for at least the reasons discussed below.

Claim 4 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Grant *et al.* in view of Cain *et al.* Since claim 4 depends upon claim 1 and since Cain *et al.* does not cure the deficient teachings of Grant *et al.* with respect to claim 1, Applicant submits that claim 4 is patentable at least by virtue of its dependency from claim 1. Therefore, Applicant respectfully requests that the rejection of claim 4 under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Applicant submits that new claim 10 is allowable for at least the same reasons as claim 4.

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In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

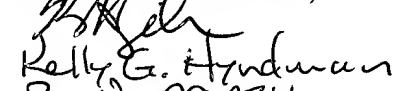
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COMMUNICATION STACK

Background of the Invention

[0001] The present invention relates to a communications stack ~~as described in the preamble of claim 1~~ that is used in a communications system comprising at least two communicating application programs. The application programs communicate over a connection via the communications stack, which comprises a connection resetting means, adapted to reset the connection by closing all connection-involved elements. The communications stack further comprises a signal reception means, adapted to receive at least one signal for managing the connection and a connection persisting means, coupled with an input to an output of the connection resetting means and adapted to keep the connection persistent.

[0002] Communications stacks are ~~Such a communications stack is~~ already known in the art, e.g., from "UNIX NETWORK PROGRAMMING" Volume 1 by W. Richard Stevens. More particularly, chapter 2 thereof describes that at a Unix process termination, either voluntarily or involuntarily, all open descriptors are closed which will cause any TCP connection that is still open to be closed.

[0003] This means that, in case of an application crash, which is called an involuntarily application close, or a software upgrade, which is called a voluntarily application close, the connection between the two communicating applications is consequently ~~reset as a consequence~~. The situation wherein subsequently a group of network settings is reset because as a result of the connection reset can be imagined. If, in case of such a involuntary application close, the application is restarted immediately after the close, the connection between the communicating applications has to be re-established which is inefficient, ~~for~~

~~instance~~ from a point of view of network load and/or processing load in re-connecting both applications.

[0004] At this close, an application communicating with a peer application, where the application or the peer application is closing or being closed, the connection between both applications is subsequently closed by means of closing the communication socket under control of at least one protocol message.

Summary of the Invention

[0005] An aspect object of the present invention is to provide a communications stack of the above known type but wherein the efficiency of the connection management has improved.

[0006] According to the invention, this aspect object is achieved by the communication stack as defined in claim 1 and the communication network element as defined in claim 3.

[0007] In this way, by delaying the resetting of a connection as consequence of an application that is closed voluntarily or involuntarily, the reset of the connection between the two routers is delayed during a predetermined period of time. If before the expiry of the predetermined period of time a signal is received indicating the successful restart of the application, the connection is kept persistent. Hence, no connection reestablishment is necessary and consequently no network conditions updating is required. This results in a connection management with an improved efficiency.

~~Another characteristic feature of the present invention is described in claim 2.~~

[0008] The decision means additionally is adapted to change said delay based on the restart time of an application program. In this way, the persistency of a connection is even better adapted to the application by configuring the delay-time dependent on the restart time of the application program. A small application program may have ~~having~~ a very short

restart time, meaning that the connection resetting delay may be quite short to guarantee proper functioning. However, with respect to a larger application program, having a substantially larger restart time, the delay time needs to be substantially large in order not to let the delay time expire and consequently, as a consequence still reset the application program. Hence, by adapting the delay-time of the connection reset to the application program, the connection persistency is even better performed.

~~Another characteristic feature of the present invention is defined in claim 4.~~

[0009] The functionality of such a Communication Network Element can be performed by a Border Gateway Protocol Router (ROU).

Brief Description of the Drawings

[0010] The above and other aspects ~~objects~~ and features of the invention will become more apparent and the invention itself will be best understood by referring to the following description of an embodiment taken in conjunction with the accompanying drawings wherein:

[0011] FIG. 1 represents a couple of communicating routers making part of an entire internet network; and

[0012] FIG. 2 represents the functional structure of the corresponding IP-communication stack COST1 of Router ROU1.

Detailed Description of the Invention

[0013] In the following paragraphs, referring to the drawings, an implementation of the present invention will be described. In the first part of this description, the main elements of the network environment together with its interconnections, as presented in FIG. 1, are described.

[0014] Subsequently, the main elements of the router ROU1, as presented in FIG. 2, wherein the communication stack of the present invention is shown, are described. This part is succeeded by a description of all interconnections between each of the before mentioned main elements of router ROU1. Finally, the execution of the implementation of the present invention is described.

[0015] It is assumed that the network environment of the present invention is an internet network comprising a plurality of routers connecting a plurality of user terminals. In order to keep simplicity in this description it is chosen to describe only two communicating routers thereof. This selection is sufficient to properly describe the principle of the present invention.

[0016] The main elements of the present embodiment, as presented in FIG. 1, are two routers ROU1, ROU2 more specifically internet protocol routers, further referred to as IP-routers. The IP-router handles the routing of IP-packets from one router to the subsequent one, based on an IP-address of the destination of the packet. Each of the routers contains a communication stack COST1, COST2, for management of a connection between two or more network elements or a part thereof, in this case between two IP-routers ROU1, ROU2. In its turn each communications stack COST1, COST2 comprises an IP-socket SOC1, SOC2 each constituting a connection endpoint of the IP-link CON and configured to implement the connection persistency. For the proper execution of the present invention it is necessary to have at least the IP-socket SOC1 of router ROU1 configured for persistency.

[0017] The Router ROU1 as presented in FIG. 2 contains a router application RAP supporting the Border Gateway Protocol further referred to as BGP. Such a BGP router application RAP is running on an operating system of each of these routers for enabling the routers to share routing information, based whereon the IP-packet routing is performed. The

router ROU1 further contains an application crash signalling means ASCM that is adapted to detect that the router application RAP has crashed by means of polling and at detection of a crash to generate a signal indicating that the corresponding application, in this case, that the BGP router-application RAP has crashed. Additionally, there is a respawning means RM that is adapted to generate a signal to restart the BGP router application RAP and additionally notify the signalling reception means SRM of the router ROU1 that the BGP router application RAP has successfully restarted. Both the application crash signalling means ASCM and the respawning means RM form part of the operating system OS.

[0018] The communications stack COST1, as presented in FIG. 2, is built up of a signal reception means SRM that is adapted to receive signals used for managing the connection over the IP-link between two routers ROU1, ROU2. A decision means DM that is adapted to delay the resetting of the connection if the received signal is an application crash signal and subsequently to decide not to reset the said connection if a subsequent signal is a successful application restart signal and this application restart signal is received before expiration of the delay. Additionally, there is a connection persisting means CPM that is adapted to keep the connection persistent by simulating that the other side is still there. Lastly, At last there is a connection resetting means CRM that is adapted to reset the connection over the IP-link between two routers by closing all in the connection involved elements. Additionally, the connection resetting means is adapted to notify the connection persisting means to stop keeping the connection persistent.

[0019] The BGP router application RAP is at first coupled to an input/output-terminal I/O₁ of the communication stack COST1. The BGP router application RAP further has an output that is coupled to an input of the application crash signalling means ASCM. Third, there is an output of the BGP router application RAP that is coupled to input I₁ of the

communication stack COST1. The respawning means RM in its turn has an output-terminal that is coupled to an input-terminal of the BGP router application RAP. The application crash signalling means ACSM further is coupled with an output terminal to an input-terminal I_i of the communications-stack and is at the same time coupled with a second output to an input of the respawning means.

[0020] The signal reception means SRM has an input-terminal that is at the same time an input-terminal I_i of the IP communication stack COST1. The signal reception means SRM on the other hand, is coupled with an output to an input of the decision means DM. The decision means DM in its turn is coupled with an output to an input of the connection resetting means CRM.

[0021] The connection resetting means CRM is coupled with an output to an input of IP socket SOC1. The IP socket SOC1 has an output-terminal O_i that is at the same time an output of the communication stack COST1. The connection persisting means CPM in its turn, also has an output-terminal that is at the same time an input/output-terminal I/O_i of the communication stack COST1. The connection resetting means CRM additionally has an output that is coupled to an input of the connection persisting means CPM. The connection persisting means CPM further has an input/output-terminal that is coupled to an input/output-terminal of the socket SOC1. In order to explain the execution of the present invention, it is assumed that the BGP router application RAP being executed by an operating system on router ROU1 closes involuntarily because of an application crash or voluntarily because of a software upgrade. The application crash signalling means ACSM detects the close of the BGP router application RAP and subsequently sends a connection terminated-signal to the signal reception means SRM of the communication stack COST1 and at the same time to the respawning means RM, forming part of the operating system OS, of the router application

ROU1. The signal reception means SRM forwards the signal towards the decision means DM that, at reception of the connection terminated-signal, delays the reset of the connection during a predetermined period of time by not forwarding the connection terminated signal to the connection resetting means CRM during the delay-time.

[0022] In the meantime, ~~mean time~~ the respawning means RM of the router ROU1 has received a signal indicating that the BGP router application RAP has crashed and is to be restarted. Therefore, the respawning means RM, will initiate the restart of the BGP router application RAP of ROU1 and after a successful restart thereof, this router application RAP sends a signal indicating that the router application RAP has successfully restarted to the signal reception means SRM of the communication stack COST1. Subsequently, the signal reception means SRM forwards the received signal towards the decision means DM that in its turn decides not to reset the connection at reception of the respawn-signal which is accomplished by not at all activating the connection resetting means CRM and hence leaving the connection persisting means CPM ignorant about the application crash. This is only the case if this respawn-signal is received at the decision means before expiry of the delayed resetting of the connection. Thus, the connection persisting means CPM keeps notifying the peer router ROU1 of normal functioning of the connection. In the meantime, ~~mean time~~ the BGP router application performed the restart without affecting any other network element and corresponding settings.

[0023] In this way, at an application crash the connection is kept up. Hence, all BGP routing tables need not be adapted for the reset connection and subsequently again for a newly established connection.

[0024] Although the above embodiments of the invention have been described by means of functional blocks, their detailed realisation based on their functional description should be obvious for a person skilled in the art and is therefore not described.

[0025] While the principles of the invention have been described above in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention, as defined in the appended claims.

[0026] The application of the present invention is not restricted to this embodiment wherein the present invention is implemented in a set of routers but may also applied in other network elements.